

The Returns on Education Investments

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EXECUTIVE SUMMARY

Education produces both economic and social returns. Economic returns include higher earnings for workers who have attained higher levels of education. Workers with at least a year of college education earn about 10 percent more than high school graduates, and those with an associates degree earn about 25 percent more. A baccalaureate degree is associated with earnings 40-60 percent higher than a high school graduate. In addition, with more income and spending power, those workers with more education also provide governments with more tax revenues. Despite fears in the mid-1970s that colleges and universities were producing too many college graduates relative to projected employer demand, the labor market has handsomely rewarded graduating students with higher wages in the subsequent decades, resulting in a widening gap between average earnings of college graduates relative to high school graduates. In addition, two longitudinal studies of early childhood program participants from disadvantaged families also show an economic return on the order of 15 percent or higher once the participants entered the labor market.

Other studies document social returns to education. One study documents an externality effect. For every 1 percent increase in the percentage of college graduates in an urban labor market, high school dropouts' wages go up by 1.9 percent, high school graduates wages go up by 1.6 percent, and college graduates' wages go up by 0.4 percent. Higher education attainment is also associated with reductions in criminal activity. Society benefits through avoided incarceration costs as well as higher rates of labor force participation and earnings. One study found that each additional high school graduate would save society \$2100 in reduced public costs. These two studies are the definitive studies in the social impacts literature, with careful attention to difficult econometric issues. A variety of other social impacts have been found, based on simple correlations that do not take into account a variety of factors that could explain the results. These correlations with higher levels of education include positive health effects due to lower rates of smoking and obesity, more voting, more volunteer activity, more charitable giving, higher rates of blood donation, and more frequent use of seat belts. All of these social impacts are externalities in the sense that no one is paying the education sector to produce these outputs, and output is therefore likely to be too low. Also, since college graduates may move to another state after completing a degree, there is an argument that only the federal government is in a position to internalize all of these effects and come to a rational decision about the optimal level of investment in education. A state, knowing that some of its college students may leave after graduation, may tend to under-invest particularly at the baccalaureate and higher levels.

Most well managed education programs produce positive private and social returns in the long run. However, the state's financial situation forces prioritizing these investments. Considering a range of potential state investments, the highest returns may come from increasing the number of college graduates by preventing dropouts at all levels or increasing higher education participation rates, and from early childhood programs. Lower returns are likely from expansion of programs for various categories of adult learners due to higher opportunity costs. However, changing demographic patterns are increasing the importance of effective programs to enhance higher education participation from minority groups and immigrants lacking basic education.

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PREFACE

When one considers the economic and social benefits of education, one immediately encounters a number of associations between observed phenomena. The association between education attainment and average personal income is a good example: average personal income clearly corresponds with education attainment, an association so close it influences public policy in a variety of ways. And there are many other associations, some of which are represented on this abbreviated list.

- Estimated lifetime earnings for people with some college total \$1.5 million; for associate degree holders the estimate is \$1.6 million; for Bachelor's degree holders the figure is \$2.1 million; for people with master's degrees it is \$2.5 million; and for people with doctoral degrees the total is \$3.4 million. For people with less than a high school diploma the figure is \$1 million, and for high school graduates the estimate is \$1.2 million (Census)
- Median income for people who did not graduate from high school is \$13,660; for high school graduates it is \$21,948; for people with some college, it is \$27,381; for associate degree holders it is \$30,753; for people with bachelor's degrees it is \$40,287; for those with master's degrees it is \$50,021; and for those with doctoral degrees it is \$64,372. (Census, BLS)
- Unemployment rates vary by ethnicity, but in each ethnic group, they correspond with education attainment. For example, when blacks attain at least a bachelor's degree, their unemployment rate drops by half (College Board).
- Nationally, tax payments also align closely with education attainment: Total estimated taxes for people with bachelor's degrees equal 24% of median earnings; for high school graduates the figure is 21.7%. In all cases the percentage applies to progressively higher income rates. Stated differently, it takes 2.2 high school drop-outs to pay the equivalent in taxes of one bachelor's degree holder (College Board).
- While 24.4% of families living below the poverty level have less than a high school diploma, this is the case with 2.4% of those with a bachelor's degree or above. (Census, Current Population Reports).
- 73.8% of people with a bachelor's or higher degree had visited a dentist within the past year, compared with 38% of those with less than a high school degree. (NCHS).
- Although infant mortality rates are also associated with race and ethnicity, they decrease proportionately with education attainment for all reported racial and ethnic categories (NCHS).

- Two-thirds of those with a bachelor's degree or higher regularly wear seatbelts while driving, compared with 39% of those without a high school degree. The figure for high school graduates is 41%, and for those with some college it is 51%. (American Journal of Public Health)
- Of those women who were unmarried and had a child in the last year (1994), 45.6% had not finished high school, 30.3% had graduated from high school, 19% had some college, and 6.1% had a bachelor's degree or higher. (Census, Current Population Report).
- 25% of those with less than high school knew that it was the Supreme Court, rather than Congress or the President that determines if a law is unconstitutional; 78% of those with a bachelor's degree or more knew this (NCES)
- 73% of those with a bachelor's degree or above; 55% of those with some college; and 36% of those with a high school diploma knew what the first ten amendments to the U.S. Constitution are called, compared with 7% of those who had dropped out of high school (NCES).
- 52% of those with a bachelor's or above; 44% of those with some college; 33% of high school graduates; and 19% of those without a high school diploma performed an ongoing community service during the year (NCES)
- 91% of those with a bachelor's or above; 80% of those with some college; 68% of high school graduates; and 51% of those without a high school diploma voted in a recent national or state election. (NCES)
- 67.2% of those with a bachelor's or above; 56.9% of those with some college; 40.4% of high school graduates; and 29.9% of those without a high school diploma report they do volunteer work, with the amount of hours volunteered each week rising progressively with attainment level. (Independent Sector Survey)
- According to national figures, "one-tenth of one percent of people with a bachelor's degree were incarcerated in 1997, while 19 times as many high school dropouts were incarcerated, and 12 times as many people with only a high school diploma were imprisoned" (College Board)
- 71% of male offenders and 83% of female offenders in the Washington prison system score at less than the 9th grade level on basic skills tests. 50% of offenders were unemployed prior to incarceration.
- 87.1% of the adults in Washington have a high school diploma, compared with 32% of the Washington State prison inmates (U.S. Department of Justice).
- As of October 31, 2005, 18% of Washington's offender population had a verified high school diploma.
- According to DSHS, 85.5% of Temporary Assistance for Needy Family recipients have 12 or fewer years of education (Public Assistance Data Analysis files).

These bullets speak for themselves, and the list could continue. But by themselves they hint at but do not offer much direction for policy makers facing decisions about investments of public funds. As noted, average personal income levels correspond with education attainment levels: less than high school, high school diploma, some college, and bachelor's degree or higher (the most popular Census classifications) in every state, including Washington. Causality is implied: increased education attainment corresponds with increases in average income, *ergo*, increased income was *caused* by increased education. Perhaps it was; the association is clear, and a causal relationship in this case may be easier to assume than, say, in the case of the observation that incarceration rates correspond with education attainment (a much smaller percentage of people incarcerated in Washington prisons are high school graduates -- c. 32% -- than is the case with the adult population -- c. 87%). They do, but the possibility of intervening variables in the second case is likely to be much greater than in the first.

Even in the case of education attainment and income, however, the references are to averages: certainly some baccalaureate holders in Washington are earning less than the average, especially during the early years following graduation, and among many who are working in socially crucial fields, and some are earning more. But whether or not, such qualifications do not simplify the quest for answers to questions about the most effective forms of public investment, e.g., if Washington were to invest more money in programs to increase high school graduation rates, would it lead to reduced incarceration rates, reduced prison costs, reduced poverty rates, and to savings that would be greater than the increased costs associated with improving the graduation rate? Or would such an investment have any effect in terms of reducing incarceration or other indicative rates at all?

Answers to such questions compel rigorous cost-benefit analysis, and there have been some of those, many of which are reviewed in this paper. These are helpful, although some readers may be troubled by the remaining need for an inductive leap from a study's finding to an investment decision. The most methodical study imaginable may reduce the breadth of the leap, but it is not likely to eliminate it. Moreover, there seems to be an inverse relationship between meticulous attention to detail and the magnitude of the conclusion in such studies. Logically and ironically, it would seem the more detailed and painstaking the investigation, the less will be its policy efficacy, or, to paraphrase Aristotle, the more one knows, the less one knows. All of this is to say that one pays a rising price for nearness to certitude.

This is not new. In his seminal book, *Investments in Learning*, Howard Bowen offered this comment about the research on higher education outcomes:

“Available studies on outcomes tend to be fragmentary, of uneven quality, and difficult to interpret. There are six principal kinds of studies: (1) investigations of changes in the achievements, personalities, attitudes, and behavior of students during their college years; (2) surveys of the views of students and alumni about their college experiences; (3) censuses, public opinion polls, and other explorations of attitudes, economic status, and behavior of adult respondents; (4) multiple regression studies for particular populations incorporating many

variables and designed to sort out the separate impact of education on income, career choice, health, voting behavior, religion, and so on; (5) case histories of individuals; and (6) critical and analytical studies without empirical data.”¹

In their Foreword to the 1997 Edition of Bowen’s *Investment in Learning*, McPherson and Schapiro also write of data limitations. “It is true now, as it was when this volume [Bowen’s book] was written [in the mid-1970s], that social scientists’ ability to measure the effects of college is limited and imprecise. Howard Bowen wrote with great sensitivity to the limits on this knowledge, but he resisted the temptation to let the imperfections of available evidence drive him into silence.”

Bowen consults all types of relevant studies in some manner or another in his study. Most, in his view, however, suffer from defects (which he describes in some detail) and most are usually out of date. Quoting Bowen, “Admittedly it would be good to have complete and reliable quantitative data as a basis for decision making in all fields of human endeavor. Unfortunately, the world is not so constituted, nor is it likely to be. Meanwhile, decisions must be reached and accountability must be achieved on the basis of such evidence as can be mustered using reasonable judgment.”²

Bowen went on to note, “Usually, studies in this area compare the monetary earnings of college educated people with those of other persons. Frequently the results are expressed as rates of return in the form of incremental lifetime earnings resulting from investments in higher education.”³ He observed that such studies focus on results and usually do not delve into the nature of causal connections. He also attempted to go further than income studies by exploring linkages between education and economic activity, but his success in this respect was comparatively speculative and modest.

In a more recent book, Robert Putnam [*Bowling Alone*] is less interested in the personal and social results and benefits, the outcomes, of higher education, *per se*, than he is in social change in America. He encounters the same sorts of problems with the data as Bowen: “. . . [L]ike researchers on global warming, we must make do with the imperfect evidence that we can find, not merely lament its deficiencies. Exhaustive descriptions of social networks in America – even at a single point in time – do not exist.”⁴

In both cases the presumed benefits of education assume both societal and economic forms. Bowen includes “Disposition toward law observance” among the citizenship qualities on his list of higher education benefits. He also considers health amelioration among the effects he attributes to higher education. In this case, “Understanding of the basic principles for cultivating physical and mental health,” and “Knowledge of how and when to use the professional health care system” are the qualities listed.

Similarly, “Progress in human quality, freedom, justice, security, order, religion, health, and so on” exemplifies one of the features of advancement of social welfare for Bowen.

¹ Bowen, *op. cit.*, p. 27.

² Bowen, *op. cit.*, p. ix.

³ Bowen, *op. cit.*, p. 158.

⁴ Putnam, *op. cit.*, p. 23.

He asserts that "Education exerts a positive influence on health. The causal connections are not wholly understood. Education may affect the use of health services, and it may be conducive toward a way of life favorable to good health. Whatever the cause, educated people are, on the average, healthier than other people, and a connection appears to run from education to health."⁵

Bowen finds a positive correlation between education and the use of health services ("Educated people visit physicians and dentists more often than others") and, although the evidence is more limited, it does suggest that education is related to ways of life that are believed to be healthful. But for Bowen, "the acid test" of the relationship is actual health as measured by disability and mortality. He cites the findings of a 1975 study by V.R. Fuchs as follows:

"One of the most striking findings of recent research on the socioeconomic determinants of health in the United States is the strong positive correlation between health and length of schooling. This result holds for several types of health indexes, ranging from mortality rates to self-evaluation of health status, *and for comparisons of individuals or populations, such as cities or states*. It also holds after allowing for the effects of such other variables as income, intelligence, and parents' schooling."⁶ [Emphasis added]

Whether good health is a social/economic or individual benefit may be a matter of perspective. It probably is both. For his part, Putnam maintains that social connectedness, engagement, is the crucial link with health, but he also notes that education is an important predictor of civic engagement. He cites a 1999 Harvard School of Public Health Study that used data from nearly 170,000 people in all fifty states that found that people who lack health insurance, who are overweight, smoke, have a low income, *or lack a college education* are of greater risk for illness than more socio-economically advantaged people.⁷ His list exemplifies the nagging presence of other factors in these relationships, but college education's presence should not be understated.

Crime rates also may provide clues. State-by-state crime rates may be reflections of the public's disposition toward law observance, but these probably have a more delicate connection to education than the public health numbers. Bowen argues that the relationship is clouded by the difficulty of separating education from other potential influences. He notes that crime is less prevalent among college students than other youths, but causal inferences are hard to draw. Obviously, white collar crime might run the other way and correlate positively with education.

Incarceration rates may be another indicator, since prison populations contain disproportionately few residents who have completed high school or college. But, again,

⁵ Bowen, *op. cit.*, p. 210.

⁶ Bowen, *op. cit.*, p. 214. The emphasis is added. Bowen's reference to this study is incomplete or inaccurate ("1975, pp. 46-47"). His only endnote reference to Fuchs is to a 1974 study, "Who Shall Live? (New York, Basic Books, 1974).

⁷ Putnam, *op. cit.*, pp. 327-28. Putnam cites Ichiro Kawachi, Bruce P. Kennedy, and Roberta Glass, "Social Capital and Self-Rated Health: A Contextual Analysis," *American Journal of Public Health* 89 (1999): 1187-1193.

the interplay is cloudy. Bowen speculates that to the extent that education produces jobs, it may inhibit the type of violent criminal activity that “flourishes in conditions of economic desperation.”⁸

Putnam also sees a relationship between education and law observance, although education may not be the strong predictor that it was for civic participation. He argues that the states with good social capital have proportionately fewer murders (“This inverse relationship is astonishingly strong – as close to perfect as one might find between two social phenomena.”) In his view, states rich in social capital tend to be wealthier, better educated, less urban, and more egalitarian in their distribution of income. Social capital in Putnam’s view is a more powerful predictor than a state’s education level in explaining variances in the number of murders per capita, although, of course, education is an important aspect of social capital.⁹

Abriane Williams and Watson Swail present the following quote from Bowen as they close out the executive summary of their report, *Is More Better*.¹⁰ It is worth citing again here:

"All things considered, perhaps we should find guidance in Howard Bowen's conclusion that the monetary returns from higher education are sufficient to offset all of the costs, and that the non-monetary returns, measured in social stability and efforts toward equality, are much greater in value: 'In short, the cumulative evidence leaves no doubt that American higher education is well worth what it costs.'"

And so it goes. Bowen, Putnam, and other studies are visited and revisited in the paragraphs that follow.

William Chance

⁸ Bowen, *op. cit.*, p. 157.

⁹ Putnam, *op. cit.*, pp. 307-308.

¹⁰ The Impact of Postsecondary Education on the Economic and Social Well-Being of American Society, May 2005, p. viii.

Introduction

This paper reviews the literature on the returns to education at all levels from pre-school through advanced university programs. The review presents the best evidence on these topics found through a survey of the academic literature as well as more applied work prepared by state agencies and various other organizations. Both economic and social returns of investments on education are considered. Private returns include the higher wages individuals earn after completing their education. Where possible, the net return is reported, taking into account investments students or their families have made to finance the students' educations.

The phrase "social return" is used in two senses in this literature. In some studies social returns refers simply to public subsidies that augment the tuition and other costs that students or their families pay. For K-12 programs offered by public schools, this public subsidy constitutes essentially all of the cost considered in the literature. For post-secondary education programs at public institutions, tuition typically covers only a portion of the costs of instruction, and the public subsidy appropriated to colleges can be compared to the increase in earnings of the graduates to estimate a social rate of return in this first and narrowest sense of the phrase. In addition, a wider concept of social return has been estimated which we call "social impact" in this paper to distinguish it from the narrower concept of social return. Social impacts include reductions in crime, lower utilization of safety net programs, improved citizenship, and a variety of other impacts attributed to higher education. In addition, an important category of social impact is an economic externality impact in the form of higher earnings of non-degreed workers who may benefit from productivity advances found in areas with a high proportion of degreed individuals in the workforce.

This paper focuses on the returns resulting from the behavior of former students as they leave schools, colleges and universities and embark on their adult lives. However, the paper does not consider the multiplier impacts of the presence of educational institutions in a city or state. There are many examples of such studies at the 2- and 4- year level. Such studies focus on the immediate impacts of the payroll of the faculty and staff, as well as the purchases these institutions make from vendors in the same area. A few of them are included in the bibliography for interested readers (see for example, Carroll and Smith, 2006; Clark, 1998; Lynch, 2004, or O'Hare, 2002). A review of this literature is provided by Goldstein and Drucker (2006) who suggest that the typical impacts study misses important externality effects on regional development, particularly in mid-sized metropolitan areas with research universities. This externality impact is discussed in the Externalities section below. The college and university impact studies do not typically consider the impacts reviewed in this paper - the long term economic and social impacts stemming from future activities of students in the workplace and society.

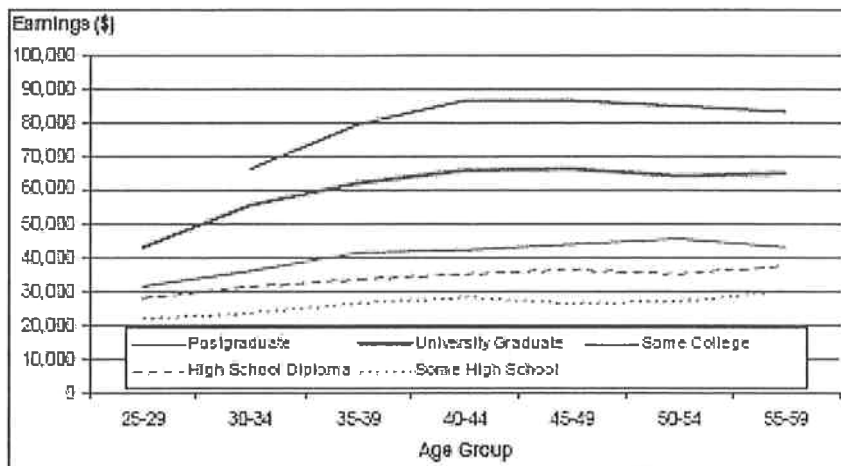
The paper covers the private and social rate of return literature first, moving from pre-school programs up through high school, community college, and university programs. The literature on broader social impacts is then considered. An extensive bibliography is

offered at the end of the paper, including internet addresses for many items which can be readily retrieved by interested readers.

The Statistical Record: More Education = Higher Lifetime Earnings

Statistical evidence stemming from the Census Bureau's Current Population Survey provides a basic source of data used in many studies to show that on average, the more education an individual has attained, the higher his or her lifetime earnings are likely to be. Hill et al. (2003) at Arizona State have compiled these data and present them in a chart that makes the point very vividly. Compared to high school drop-outs, whose average earnings range from \$20,000 to \$30,000 per year, individuals who have gone on to graduate from high school or to post-secondary education tend to have much higher earnings. Furthermore, the further up the educational ladder one climbs, the greater is the earnings increase, as can be seen by examining the distance from the some high school to high school graduate line to the distance from the high school graduate to the college graduate or graduate degree holders. The wider spacing of the upper educational attainment lines indicates an increasing return to higher levels of education. Opportunity costs of obtaining a bachelors or higher level degree are not considered in this chart. Rolnick and Grunewald, two economists from the Federal Reserve Bank of Minneapolis, observe that the returns to higher education have grown over time. The difference between the wages of college and high school graduates was on the order of 40 percent prior to 1983. More recent estimates peg this differential at 60 percent. Prior to 1985, the earnings of a person with a graduate degree exceeded those of a high school graduate by 60 percent. Since then this differential has grown to 100 percent (Rolnick and Grunewald, 2003).

Mean Annual Earnings by Age and Educational Attainment in the United States (full-time, year-round workers, 2002-03)

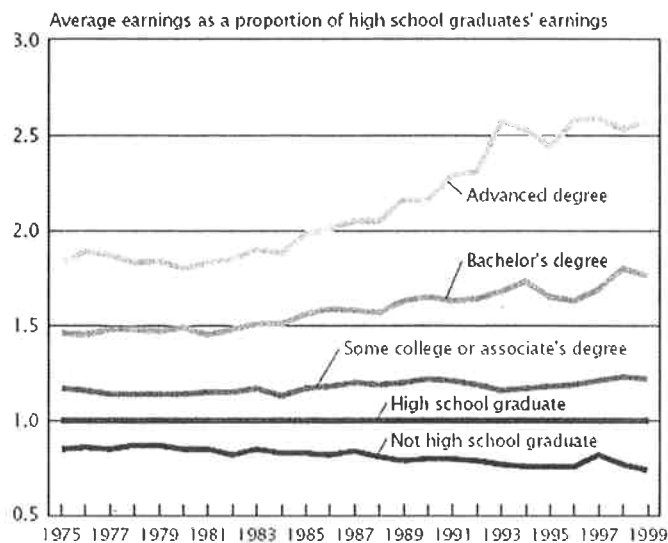


Source: U.S. Department of Commerce, Census Bureau, Current Population Survey.

From Hill et al. 2005, p. 14

A report by Census Bureau researchers Cheesman Day and Newburger (2002) shows that the earnings of bachelor's and graduate degree holders have been growing relative to a high school diploma since the mid-1980s. As of the year 2000, a bachelor's degree holder could expect to earn 1.7 times what a high school graduate would earn, and advanced degree holders were earning 2.5 times what a high school graduate could expect. While minority group members earn less than white non-Hispanic at all education levels, the returns to higher education levels are quite significant for all racial/ethnic groups.

Average Earnings of Full-Time, Year-Round Workers as a Proportion of the Average Earnings of High School Graduates by Educational Attainment: 1975 to 1999



Source: U.S. Census Bureau, Current Population Surveys, March 1976-2000.

Source: Cheesman Day and Newburger, 2002, p. 3

Pittenger (1999) makes many of the same points for Washington residents using data from the state population survey. Low incomes are associated with low levels of education attainment, and conversely, high income households tend to have highly educated members. Pittenger suggests that a bachelor's degree is the tipping point for entry into higher income categories since individuals with "some college" are not much higher than incomes of high school graduates. Persons with bachelor's and advanced degrees make up 75 percent of the population with incomes over \$75,000.

These national and state data establish the basic case for a substantial return to investment in higher education that increases an individual's human capital, capital that earns a return after the individual enters the workforce. However, these broad statistics do not consider the costs associated with obtaining a level of education, nor the impacts of particular public investments such as pre-school programs or access to a nearby community college to start post-secondary education. Nor do these broad statistics show

the role that public programs may have played in helping displaced adult workers re-enter the workforce.

To understand the impacts of public investments, the statistics must be unraveled and associated with the investments made in educating or training various groups of people. Beginning with Gary Becker, a long line of economists and policy analysts have framed the issue as a set of public and private investments in human capital that earn a return in the labor market as the educated individual enters the workforce. Viewed as a set of capital investments, one can begin to unravel the statistics, and estimate the return on particular investments such as a pre-school program, a displaced worker program, or public appropriations to public higher education. Becker notes that the research literature shows substantial returns to investment in education, even after netting out schooling costs, and adjusting for “IQ” or other measures of the intelligence and prior preparation of entering college students, and the wealth and education level of their parents. In addition, one can readily interpret falling rates of enrollment in higher education when college education rises rapidly or when labor markets tighten, forcing employers to hire less qualified workers (Becker, 2002).¹¹

Becker’s concept of human capital investments includes investments in health and the efforts of parents, religious and community organizations to instill good values in youth. However, his primary emphasis is on investments in education and training. What does the literature say about the impacts of education and training investments? We attack this question beginning with literature on pre-school investments. The literature discussed below reflects our sense of the highest quality material on a vast subject. “High quality” means that the literature reviewed uses established and well regarded research methods to isolate extraneous factors, hold constant personal characteristics when establishing impacts on very diverse populations, and establishing causality in very complicated environments when statistical correlations may suggest impacts that could be due to unobserved or poorly modeled factors. The bibliography appended to the report contains many items not mentioned in the report. The literature is simply too vast to include every detail in the report; the bibliography provides a broader selection of the literature for readers who wish to pursue the subject further.

Economic returns

Early childhood programs

Estimating the human capital impacts of early childhood programs requires a long term research strategy since the impacts are not fully realized for decades. Two often-cited studies involved long-term follow-up of individuals who participated in a pre-school program to establish long term impacts, including earnings after these individuals entered the workforce two decades later.

¹¹ See Minnesota Higher Education Services Office (2000) for an example of a state agency translating these hypotheses about business cycle impacts on higher education enrollments into practical projection methodologies.

Rolnick and Grunewald (2003) summarize impacts found in a longitudinal study of students enrolled in a pre-school program offered at the Perry School in Ypsilanti, Michigan in the 1960s. Low income African-American children aged 3-4 enrolled in the 30-week program attended daily 2½ hour sessions and also received a mother/child home visit once a week. The program was taught by certified teachers paid a 10 percent premium on normal wages at this school, and the student/teacher ratio averaged 6. These students were compared to similar children up to the age of 27. The sample was small – 123 children in the “experimental” group, but at the end of the program 117 were contacted for the final stage of the evaluation, a remarkable participation record for a longitudinal study. A total of 65 percent of the Perry pre-school students graduated from high school, compared to 45 percent of the control group, and four times as many of the pre-school cohort were earning at least \$2,000 per month at age 27 compared to the control group. Rolnick and Grunewald report a private and public return of \$8 for every dollar invested in the Perry pre-school program.¹²

This is a very high cost-benefit ratio, but it should be noted that 24 years elapsed before this return was fully realized. If one invests \$1 in year 1, and then earns \$1 each year in years 20-27, corresponding to an individual who goes through school and perhaps some college and enters the workforce at age 20, then the net present value of the \$1 pre-school investment, ignoring all other educational investments, is \$5.84 assuming a 3 percent “inflation free” interest rate. Grunewald and Rolnick do not present any data on other educational investments society or the students’ parents made in these 117 individuals, but if the control group on average received the same K-12 and post-secondary investments as the pre-school students, then we can ignore these subsequent investments in estimating the rate of return on the pre-school program. A discounted return of nearly \$6 on every dollar invested is a substantial return, indicating that the Perry School did well by these students.

Another well-known longitudinal study of pre-school interventions was conducted by Reynolds et al. (2003) who examined data concerning over 1500 children in Chicago. Participants were followed for 18 years, up to the age of 21, and data are reported on the 85% of the original sample who were contacted at age 21. Of the 1500, 989 disadvantaged children participated in a pre-school program and 550 similar children did not, serving as a comparison group. Comparison of workforce outcomes for the pre-school participants and the comparison group suggest a cost benefit ratio of 7.14.

These are the two best known longitudinal studies of pre-school programs, and both studies demonstrate very substantial impacts for quite modest investments made at an early age to prepare children and their parents for the K-12 education experience. In both studies, a variety of social impacts are also documented including lower rates of criminal activity and lower rates of usage of welfare and other safety net programs.

Other studies have examined statewide impacts of universal voluntary pre-school programs that are available in several states. Gormley and Phillips (2005) examined

¹² Other research on the Perry pre-school program can be found at <http://www.highscope.org/NewsandInformation/PressReleases/PerryP-Age40.htm>

impacts of such a program Tulsa, OK, finding substantial impacts on cognitive development of minority children; however, these authors do not comment on costs or economic benefits of these impacts. Belfield (2005) extends the argument into the realm of economics, looking at long term fiscal consequences of universal pre-K programs in three states: Massachusetts, Wisconsin, and Ohio. He utilizes a model built on findings from the literature on social impacts to estimate the costs and benefits of universal pre-kindergarten programs in terms of reduced use of special education programs, reduced grade repetition, and a variety of other effects that raise the efficiency and reduce the costs of primary and secondary education. In addition he considers the increased ability of parents to enter the workforce because their children are enrolled in pre-K programs, higher earnings, improved health and lower incarceration rates of the pre-K students in adulthood. He finds a positive cost-benefit ratio in all three states with a more aggressive version of his impact model, but a very low ratio in one state and a negative ratio in another using a very conservative version of the impact model. And Bartik (2006) uses estimates of the impacts of the Chicago pre-school program (see Reynolds et al. above) to compare investments in pre-school programs to investments in a traditional recruitment-based economic development program. He concludes that these two alternative investments have returns of comparable magnitude, but notes that the return on pre-school investments are longer term and subject to spillover effects on other states due to population migration. Therefore, he suggests that the federal government should invest more heavily in pre-school programs since the spillover effect is largely internalized at the national level.

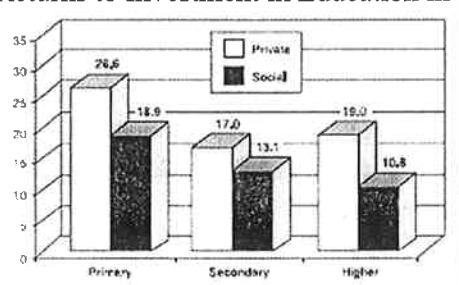
Lynch (2004) provides a summary of the leading studies of early childhood effects, and offers some projections on the costs and benefits of a national program to provide early childhood education to all 3- and 4-year who are living in poverty. The estimated budget costs to all levels of government would amount to about \$20 billion in the first year of full implementation and would decline thereafter since the program should result in growing savings over time in K-12 education, social assistance, and criminal justice spending. Eventually higher wages of those benefiting from early childhood education would provide additional tax revenues. Lynch concludes that savings and new tax revenues would offset costs after the 17th year of the proposed program, contributing a small surplus to the combined federal/state/local budgets thereafter. Note that Lynch is focusing narrowly on the returns to government itself in the form of reduced social program costs or increased tax revenues. He does not include the broad economic impact of the higher wages of workers who participated in pre-school programs in their childhood, suggesting that in a broad benefit-cost analysis a positive net impact point would be reached much earlier than the 17th year.

Completing High School and Going on to College

The statistical evidence provided in the introduction is strongly suggestive of a substantial rate of return to education, but it does not take into account the cost of providing that education. Education can be thought of as an investment similar to investing in physical capital or in stocks and bonds. Society as well as parents make these investments, expecting an economic return in the form of higher wages as well as social benefits from the graduates. The higher wages in turn generate higher tax

payments to government, providing a financial return that may offset or even exceed government costs of providing education. Many studies have been conducted, not just in this country but throughout the world, showing that once public and private costs are properly taken into account, there is a positive and quite substantial rate of return on educational investments. Psacharopoulos and Patrinos (2004) review a large number of studies from 73 countries. The figure on the next page summarizes their results by level of education. Given the international scope of their study, they divided their results into three levels of education: primary, secondary, and higher. These terms correspond to approximately 8th grade, high school, and baccalaureate and beyond in U.S. terms. They find private returns, essentially workforce earnings to the workers themselves, of 29 percent for primary school completers, 17 percent for secondary school completers, and 19 percent for college completers. Social returns, that is, the earnings of graduates compared to public investments in education, ranged from 19 percent at the primary level to 13 percent at the secondary level, and 11 percent for higher education.

Returns to Investment in Education in 73 Countries



Source: Psacharopoulos and Patrinos, 2004, p. 112

Hill et al. consider just the returns to earning a bachelor's degree in the United States. Their results, shown in the table below, net out the costs from the benefits, and use a discount rate calculation to account for the fact that benefits occur over the course of a career following exit from the educational system. Net discounted benefits of a bachelor's degree for men are \$338,465 greater than exiting the educational system with just a high school diploma, and are \$250,380 greater for women, in the United States. These benefits correspond to a combined public and private rate of return on investment of 11.7 percent for men and 11.6 percent for women.

Value of a Bachelor's Degree

	Men	Women
Costs (Ages 18 to 21)		
Tuition, fees, government appropriations	\$60,000	\$60,000
Foregone earnings	70,592	57,292
Total costs	130,592	117,292
Total costs, discounted at 4 percent real interest rate	123,250	110,696
Benefits		
Earnings with a high school diploma	1,734,824	1,243,838
Earnings with a four-year degree	3,012,522	2,202,327

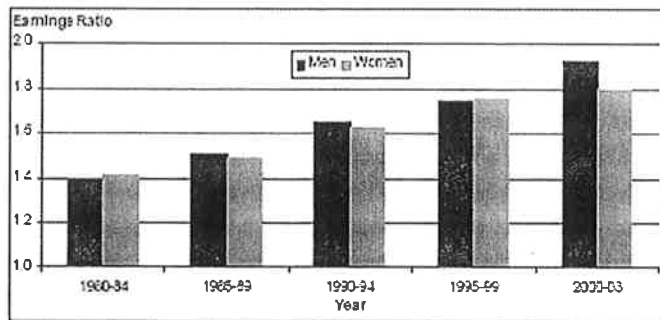
Differential in earnings	1,268,698	958,489
Earnings differential discounted at 4 percent	461,715	361,075
Net present value of a bachelor's degree	338,465	250,380
Internal rate of return	11.7%	11.6%

Source: Hill et. al. 2005, p. 17

Other significant studies elaborate or refine these results to look at impacts on different levels of education or various sub-groups within the population. Monk and Turner (1994) estimated the return to 27 year old individuals for investing in a 2-year community college degree and for investing in a 4-year degree, both relative to just completing a high school diploma. The rate of return on the associate degree investment was estimated at 5.4 percent and the bachelor's degree at 7.9 percent. Other studies suggest an increase in the rate of return over time, and these estimates are probably low for current students. Kane and Rause (1995), using data from the early and late 1970s versions of the National Longitudinal Study of Youth, found that students who earned a baccalaureate degree earned 10-20 percent more than holders of associate degrees, and that associate degree holders earned 15-25 percent more than high school graduates.

However, no other articles explicitly compare returns to 2- and 4-year degrees. For example, Marcotte et al. (2005) estimate that a year of community college education raises earnings by 5-10 percent, using data from the National Education Longitudinal Survey of students who were in 8th grade in 1988. Earlier work by Grubb (1993, 2002) found similar, but slightly smaller impacts with data from the National Longitudinal Study of Youth from earlier years. Bryant (2001) estimates that earning at least 30 credits at a community college is associated with a 15 percent long term earnings increase compared to high school graduates, but does not consider what the earnings increase is for bachelors degree holders. Carnevale (2000) observes that average earnings by level of educational attainment can be very misleading because there is a considerable area of overlap between the earnings of associate degree holders and bachelors degree holders. Hill et al. (2003, p. 15) portray increases in the earnings differential between 35-44 year old bachelor's degree holders and high school graduates over time, but do not consider the differential associated with an associates degree. Watts notes that the higher incomes earned by Kentucky's 4-year college graduates over the course of their careers translate into higher tax revenues for the state and the federal government -- an estimated \$23,000 more in state income tax revenues and about three times that amount for the federal government (Watts, 2001, p.xiv).

Earnings Differentials of Individuals Aged 35-44 over Time Bachelor's Degree Holders Compared to High School Graduates



Source: U.S. Department of Commerce, Census Bureau, Current Population Survey

From Hill et al. (2003), p. 15

The increasing return to higher education investments was not anticipated by labor economists who started studying these issues in the 1960s and 1970s. An interesting collection of essays was published in 1974 by the Carnegie Foundation. Summarizing findings of several contributors in an introductory essay, editor Margaret Gordon expresses considerable concern about “credentialism,” the practice of employers hiring college graduates for jobs that may not require that level of education. Early writings by MIT economist Lester Thurow raising the issue of credentialism are among those Gordon cites. Employers who hire college graduates for jobs someone with less education could perform adequately, she says, are hoping that the technical competence required for the job will be accompanied by a critical thinking capacity acquired in completing a college degree, a capacity that may be valuable to the employer. However, over-supply of college graduates in the 1970s was expected to reduce the earnings differential between college and high school graduates (Gordon, 1974, p. 19). Richard Freeman raised this issue very prominently two years later with a book called “The Overeducated American” (Freeman, 1976).

Instead of the narrowed wage differential Gordon, Freeman, and others expected, the historical record portrayed by Hill et al. in the chart above shows a widening differential. Employers have shown a consistent preference for more highly educated workers over the last 40 years. This is an important finding since the basis for the credentialism argument lies in the same occupational forecasting system that exists, with modifications and improvements, at the present time. This forecasting system is projecting a balance between overall supply and demand for workers with baccalaureate degrees in the next decade.¹³ This current projection should be treated with considerable skepticism given the historical refutation of the credentialism hypothesis in recent history.

In summary, economic returns to education are substantial. Pre-school interventions can have substantial long run returns of \$7 or \$8 for every dollar invested as suggested by two long term longitudinal studies of individuals who were enrolled in pre-school

¹³ See Higher Education Coordinating Board, State and regional needs assessment report, Olympia, October 2005, pp 24-30.

programs. Primary, secondary, and higher education programs yield substantial rates of return in studies conducted in over 70 countries. In the U.S., recent studies show a steady increase in the rate of return since the 1960s, with recent estimates pegging the returns to a bachelor's degree at about 12 percent. One study from the mid-1990s demonstrated that a 2-year degree from a community college has a smaller impact than a 4-year degree, with the 2-year degree associated with earnings of about two-thirds of the amount associated with a 4-year degree.

Vocational and Workforce Training

Not everyone studying at a community college is pursuing a degree. Many colleges provide shorter term training for displaced workers. Two articles by Louis Jacobson and colleagues consider the rate of return on these programs using administrative data from 25 colleges in the State of Washington. They find that a year of additional college raises the future earnings of displaced workers by at least 7 percent, with a greater effect on women than on men (Jacobson et al. 2005). However, in a prior paper, these authors consider the opportunity costs of that year of training, on the assumption that many of these workers could have found a new job instead of going back to college. For workers aged 35 or higher, a year invested in college is associated with an 8 percent rate of return for men and 10 percent for women. When these student-workers' opportunity costs are taken into account, the rate of return drops to 2 percent for men and 4 percent for women (Jacobson et al. 2003).

A General Accounting Office report published in 2004 finds that definitive statements cannot be made about the impacts of workforce training programs funded by states through payroll taxes. 23 states offered such programs, with an aggregate budget of \$278 million, and 22 of these states conducted some sort of evaluation of the impacts of these programs. However, GAO concludes that "none have used sufficiently rigorous research designs to allow them to make conclusive statements about the impact of their programs, such as their effect on worker wages or company earnings." (General Accounting Office, 2004, executive summary)

Several studies have been done by Kevin Hollenbeck of the Upjohn Institute together with several colleagues, linking data on training program participants with workforce outcomes data from state labor agencies. Hollenbeck (2004), using administrative data from Washington State, finds 10 to 15 percent increases in employment for dislocated Washington workers who participated in federally funded job training programs, and 5-10 percent increases in earnings. These findings come from studies using a quasi-experimental design in which workforce outcomes of training program participants are compared to similar dislocated workers who did not participate in training programs. Hollenbeck et al. (2003) report preliminary findings from 6 states, including Washington, looking at earnings 4 quarters after exit from a federally funded training program. They find very small impacts on earnings in several of the states, and negative impacts in some of the states.

Finally, Hollenbeck and Huang (2003) examines workforce outcomes of a number of federally funded training programs in Washington State, using a quasi-experimental

design comparing program participants who exited training programs in 1997-98 to similar non-participants. Short and long term impacts are considered in a cost-benefit framework, with generally positive impacts for 7 of the 9 programs evaluated in the long term (two years after exit) but some negative impacts in the short term. Since new hires often are offered low starting wages and then are given raises if they perform well, the short term impacts should be discounted and more attention paid to the longer term impacts.

This limited review of literature on workforce training suggests small but generally positive impacts on dislocated workers who participate in training programs before re-entering the workforce. However, opportunity costs of training program participation reduce the net impact estimates substantially. Still, even the Jacobson studies show positive, if small, impacts when opportunity costs are taken into account.

Externalities

Externalities are the first type of social impact considered in this review. Externalities arise when economic impacts are not confined to producers and consumers of a product or service. In the case of higher education, utilization of skilled workers by employers leads to productivity increases that spread the benefits of higher education beyond the immediate workplace. Regional productivity impacts are found by Moretti (2004a and 2004b), and Gottlieb and Fogarty (2003). In each of these papers, difficult methodological issues are tackled in order to isolate the impacts of education expressed through some form of externality.

Moretti (2004a) uses both a longitudinal study of individuals as well as cross sectional data to establish that there are externalities associated with the presence of a well educated workforce in a city. The longitudinal sample of 6,791 individuals from 201 cities is derived from the National Longitudinal Study of Youth, a Bureau of Labor Statistics sample of youth who were surveyed annually from 1979 to 1996. By following these individuals over time, impacts of the average level of education in a particular city can be discerned while holding constant individual characteristics. However, this approach leaves open the possibility that unobserved characteristics of cities are attracting more talented individuals. In a separate section of the paper, Moretti uses a sophisticated econometric methodology to analyze cross-sectional data to control for these city effects. His overall conclusion is that a 1 percent increase in the percentage of college graduates in a city is associated with externality impacts on the wages of other city residents:

- 1.9 percent wage increase for high school dropouts,
- 1.6 percent wage increase for high school graduates,
- 0.4 percent increase in the wages of college graduates.

Moretti (2004b) shows that manufacturing plants located in cities with high levels of college graduates have greater productivity than plants located in cities with lower levels of educational attainment. He concludes that a 1 percent increase in a city's share of workers with a college degree is associated with a 0.5 to 0.7 percent increase in

productivity. These productivity differences are associated with higher wages in the cities with more college graduates.

Gottlieb and Fogarty (2003) use Census data from 1980 to identify the 10 metropolitan areas with the highest percentage of college graduates among the population over age 25, and the 10 with the lowest percentage of college graduates, from a sample of the 75 largest metropolitan areas in the country. In 1980, the 10 most educated areas had per capita incomes 12 percent above the national average, while the 10 least educated areas were 3 percent below the national average. Over the next 20 years, the gap between these two set of cities widened dramatically. In the 10 metropolitan areas with the highest percentage of college graduates, real per capita personal income grew 1.8 percent annually, while in the 10 with the lowest percentage of college graduates, per capita personal income grew by just 0.8 percent annually. Employment growth rates were similar, albeit a bit larger in the cities with more college graduates (2.7 percent annually) than in the cities with proportionally fewer college graduates (2.5 percent). Second, using a larger sample of 267 metro areas, a regression analysis demonstrates a strong association between education attainment and both real per capita personal income and employment growth, controlling for the effects of region, industry structure, and rate of labor force participation.

These three studies, all published in prestigious economics journals, demonstrate that regions with more college graduates as a percentage of the workforce have higher wages, higher productivity in manufacturing plants, and higher rates of income growth in recent decades. Furthermore, the wages of all workers are higher in the cities with a higher proportion of college graduates. None of these papers consider overall educational attainment levels, or specifically the impact of a higher percentages of workers with some college but less than a bachelor's degree.

A final paper by Goldstein and Drucker (2006) finds that research universities, especially those in medium sized metropolitan areas, have substantial externality impacts on their surrounding regions. Their findings are based on a regression analysis of data from 330 US metropolitan areas. Research, teaching, and technology development programs all have positive impacts on surrounding regions, contributing to stronger income growth, especially in small and medium sized metropolitan areas, those with less than 200,000 residents.

Social Impacts

A variety of social impacts have also been associated with higher education levels, including reduced crime rates, higher voting rates, more volunteerism, etc. The social impacts literature varies greatly in the sophistication of research methods employed and the confidence one can place in the results.

Coley and Barton (2006) review trends in incarceration in the United States, noting that the rate of incarceration has gone up from 313 per 100,000 residents in 1985 to 726 per 100,000 in 2004. States vary greatly in how much they spend on educating prisoners; New Jersey spends an average of \$6,500 per participant, while Wisconsin spends less

than \$500. Washington's spending level is not reported, a footnote says that states not included did not respond to the survey. Coley and Barton conclude that investments in education of prisoners may have a positive social return due to lower rates of re-incarceration, but do not offer any estimates of the size of these social impacts or the rate of return the public might realize by investing in education of prisoners.

Lochner and Moretti (2003) extend the argument for social impacts, arguing that more education is associated with lower rates of criminal activity once some difficult econometric issues are sorted out. In particular, previous studies found low correlations between education levels and criminal activity, but did not take into account unobservable characteristics of individuals that may be correlated with also unobservable characteristics that pre-dispose individuals to criminal activity. Some states have increased the number of years of compulsory schooling, thereby providing natural experiments that are useful in dis-entangling personal characteristics from the effects of schooling. Data from the National Longitudinal Survey of Youth allow the authors to hold constant personal characteristics. Regression analysis of NLSY data, including individuals from states where education requirements have gone up and individuals where there has been no change in compulsory schooling suggests that one additional year of schooling (pre-college) is associated with a 0.1 percent decrease in the probability of incarceration for whites and 0.37 percent for African-Americans. A separate data set with information on arrests confirms the general magnitude of these effects. Given the costs associated with incarceration, Lochner and Moretti suggest that a 1 percent increase in male high school graduation rates nationwide would result in public sector savings of \$1.4 billion, or \$2,100 per high school graduate. These authors do not present any data on the potential costs of achieving a 1 percent increase in graduation rates.

Steurer et al. (2001) extend this argument to education of prisoners, using data from prisoners incarcerated in Maryland, Minnesota, and Ohio in 1997 whose status was determined in 1998 after release from prison. Data on inmate characteristics including participation in prison education programs was collected from approximately 1,000 inmates about to be released in each of the three states; data were assembled on a total of 3,170 individuals from the three states. The entire release cohort was studied, a quasi-experimental design taking advantage of differences in participation in prison education programs in each of the three state cohorts. Parole officers were surveyed to determine the status of these individuals after release. Recidivism rates were determined using federal data on arrests and convictions for a three year period after release. Employment data was obtained from state employment offices for the same post-release period in Maryland and Minnesota; comparable data from Ohio could not be utilized due to an unexplained incompatibility in data formats. Education participation while in prison was measured by a simple dichotomous participation or non-participation variable since no data were available on the extent of participation. No information is available on the nature of the education programs offered to these individuals, making it likely that the "treatment" received by those rated as participating in prison education programs was highly variable. In Maryland, 31 percent of the cohort participated in education programs; in Minnesota, 55 percent participated; in Ohio, 43 percent participated,

resulting in 1373 education program participants in the pooled sample and 1797 non-participants. Major results of the study include:

- 29 percent lower re-incarceration rate for participants in education programs.
- Little difference on the rate of employment – 77 percent for participants and 81 percent for non-participants.
- Substantial wage differences as shown in the table below.

Wage Outcomes for Ex- Prisoners

Years after release	Participants	Non-participants
Year 1	\$7,775	\$5,981
Year 2	9,353	\$8,492
Year 2	10,629	\$9,558

Source: Steurer et al. 2001, p. 43

The reported wage effects in this study are quite striking, but the study's weakness's are also apparent in that the "treatment" effect is not described in any detail. Also there is no assessment of the strength of labor markets into which prisoners were release and it is possible that there was some systematic difference in the opportunities faced by participating and non-participating prisoners. The intriguing but somewhat unsatisfactory nature of this study serves as a spur to further research. If there is a general correlation between more education and less crime, as Lochner and Moretti show, and if the provision of education to prisoners could help to prevent future criminal activity after release from prison, there would be a strong argument for expanding prison education programs. However, a stronger case needs to be built for the efficacy of in-prison education.

Other work on the relationship between education and subsequent criminal activity is even less convincing, but nevertheless intriguing. A just released National Bureau of Economic Research working paper helps to make that case. Tyler and Kling (2006) compared Florida inmates who earned a GED in prison to similar prisoners who did not earn a GED in prison. Some of the individuals in the comparison group did earn GEDs outside of prison. However a comparison of their earnings after release showed a 15 percent advantage to those who earned GEDs in prison. These effects of the in-prison GED program were found only for minority group members, and the effects disappeared after three years in the labor market outside prison. This transitory effect, linked with population characteristics, suggest some causal mechanism other than simply educational attainment is at work. Fine et al. (2001) compared 274 women who attended college while in prison to 2,031 women who did not attend college while in prison; the in-prison college attendees were significantly less likely to be re-incarcerated (7.7%) than those who did not attend college while in prison (29.9%). With no controls for inmate characteristics, this study cannot be regarded as definitive, but like the other works on prisoners and education, the results are intriguing and suggest issues for further research with improved research design.

A variety of other social impacts have been attributed to education, but often on the basis of simple correlations and without controls for unobserved characteristics of populations or places that might be the true causal factors. While these impacts may be truly due to

education, more sophisticated research is needed to confirm impacts. Among the suggested impacts are:

- Lower unemployment
- Poverty reduction
- Improved health, to some degree based on lower rates of smoking among more highly educated adults
- More volunteerism
- Higher voting rate, and
- Greater frequency of blood donations.

All of these factors are featured in a College Board report that shows correlations to these and many additional variables; however, the College Board study does not go beyond correlation to test causation (Baum and Payea, 2004).

Watts (2001) uses regression models to show relationships between education and positive social outcomes, based on data from Kentucky. Watts also estimates financial returns to the state based on budget data. Among the findings are:

- Estimated savings on state assistance and food stamp programs of \$1,736 for a woman and \$1,586 for a man if education attainment increases from high school diploma to bachelor's degree;
- Lower incarceration rates resulting in savings of \$8300 per year comparing a college graduate to a high school drop-out;
- A 14% lower probability of smoking in the last 30 days comparing a college graduate to a high school drop-out; and
- A 10% increase in charitable giving comparing college graduates to high school graduates.

Kenkel et al. (2004) examine the smoking issue in some depth using data from the National Longitudinal Study of Youth. With this rich data set they can control for many individual characteristics that may be associated with smoking while examining the impact of education in regression models. They find that males who graduate from high school are less likely to be lifetime smokers. Weaker relationships are found for men who earn a GED and for women generally.

Investment Options

A wide range of investment options are conceivable for a state that wants to do a better job of educating its citizens, starting with pre-school programs, but also including improvements in the K-12 system, strengthening academic transfer and workforce programs at the community colleges, providing more capacity at the university level, and adding more capacity in graduate programs. A reasonable argument can be made for a positive return to well designed investments in any of these areas.

This section considers some of the literature recommending various investments in other states and attempts to construct a rough rank ordering of potential investments by likely rate of return. Much of the literature reviewed in this paper is not designed to provide a simple rate of return estimate, and therefore the investment options considered below are

grouped in three likely rate of return categories: large return on investment, medium return on investment, and low return on investment. A rationale for assignment of each option to one of these rate of return groups is provided in the discussion below.

Large Rate of Return Options

Early Childhood Programs

Nobel laureate James Heckman (2006) makes the case for early childhood program investments targeted at disadvantaged children. He suggests that the economic returns in terms of later earnings will be in the neighborhood of 15 to 17 percent, and notes additional social impacts in terms of criminal justice and health impacts. Against the compelling evidence that Heckman and others have assembled on early childhood program impacts, the spillover of benefits to other states must be taken into account, reducing the state level return considerably. The spillovers imply that national investments would be most efficient; any individual state may tend to under-invest because many of the early childhood program participants may end up working in another state as adults. Of course, this spillover problem applies to any education investment, providing a strong rationale for a stronger federal role in funding education. This review has considered only the two seminal studies on long term impacts of early childhood programs. Other literature evaluating cognitive and other impacts of early childhood programs should be examined to determine specific investment options.

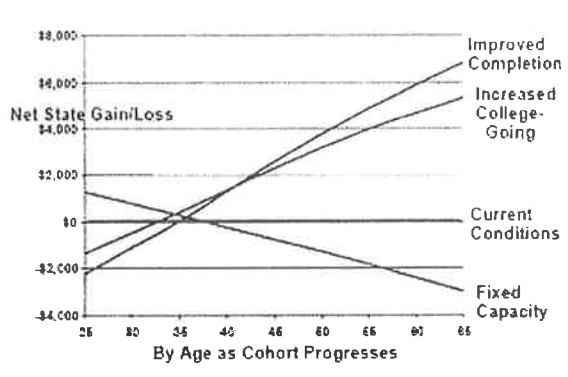
Investing in Higher Education

Brady et al. (2005) developed a simulation model to estimate impacts of investments in California's higher education system. They conclude the limiting capacity in the higher education system will have positive impacts on the state budget in the short run, but longer term impacts will be negative, costing the state two dollars in lower earnings and tax revenues as well as higher social program costs for every dollar saved in the short term. They argue for two investments that each have approximately a 3 to 1 positive impact:

- increased college going (higher participation rate), and
- improving completion rates.

Improved completion rates have somewhat higher returns than higher participation rates in the long term as seen in the following chart:

Net Gain or Loss to the State of California from Alternative Education Policies



Source: Brady et al. 2005, p. 114

Ewell et al. (n.d.) define an educational pipeline and estimate the “leakages” from the pipeline as students stop participating. The significant stages in the pipeline are:

- Graduation from high school
- Entry into postsecondary education
- Persistence in postsecondary education
- Completing postsecondary education
- Entering the workforce

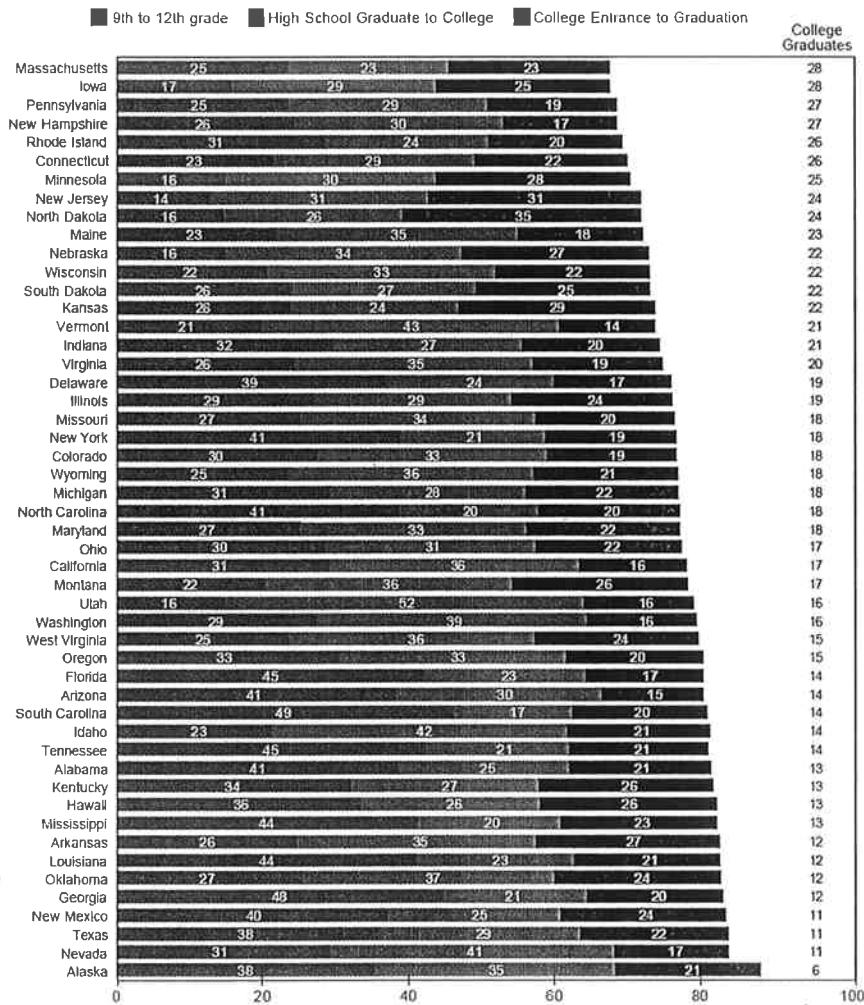
They show data on how many students drop out of the pipeline at each stage and discuss a range of policy options that could reduce the rate of non-participation at each critical stage. However, they do not offer any estimates of the costs or quantitative benefits of these options. The chart on the following page shows the data by state on pipeline “leaks;” the states are ordered in the table by the final contribution each state’s pipeline makes to the supply of college graduates. Washington falls 31st on the list, somewhat below the median.

Ewell et al. outline a number of potential investments that could reduce the tendency to drop out of education:

- Graduation from high school
 - Improve foundation skills through more rigorous courses in early grades, targeted at closing gaps between lower and higher socio-economic status children
 - Parental, employer, and community involvement
 - Financial equalization providing more resources to high dropout districts
- Entry into postsecondary education
 - Affordability strategies aimed at state’s poorest citizens
 - High capacity open entry 2-year college system coupled with ready geographic access to transfer institutions
 - Speed the transition from high school to college through dual enrollment or advanced placement
 - Alignment between high school graduation and college entrance requirements
- Persistence in, and completion of, postsecondary education
 - Learning communities and other academic support programs for freshmen
 - Intensive enrollment in foundation coursework in first year of college

- Schedule responsiveness to student needs
- Affordability policies
- Effective transfer arrangements

NCHEMS Educational Pipeline
Of 100 9th Graders—Loss at Each Stage of Transition (2000)



Source: Ewell et al., n.d., p. 6.

Taken together, Hill et al. and Ewell et al.'s research suggests that low cost programs to plug leaks in the higher education pipeline would be especially attractive investments to boost a state's baccalaureate degree production. However, there is no track record in the published literature reporting on the efficacy of steps such as those Ewell et al. recommend. Hill et al. recommend two alternatives – increasing participation rates and improving completion rates – without specifying specific strategies to achieve either goal. If Washington State adopts policies to reduce pipeline leaks or increase participation, early efforts will have to be carefully monitored to assure cost effective results.

Medium Rate of Return Options

Tailored investments to increase science and engineering

The General Accountability Office (2005) reports that the percentage of all national college students going into science, engineering, and mathematics fields has increased from 21 percent in 1995-96 to 23 percent in 2003-04. The absolute number of graduates in the science, engineering, and mathematics fields actually went up by 8 percent, but the rate of increase was very rapid in non-technical fields of study. The report lists several factors influencing student decisions about whether to enter technical/scientific majors:

- Teacher quality in K-12 schools,
- Math and science course completion in high school, and
- Mentors, especially for women and minorities.

Barton (2002) finds that there is shortage of scientists and engineers in the US, driven by both expanding demand and declining degree production in these fields. After reviewing workforce trends data showing rapid growth of minority groups within the population, he concludes that the solution to shortages of scientists and engineers will require more entry into relevant college majors by minorities, and that in turn will require new efforts at all levels of education to increase the number of students mastering high school math and science so as to have the option of entering science and engineering majors in college. Hill et al. (2003) suggest that college graduates are very mobile and that a single state trying to increase the educational attainment of its population would have a very low rate of return if increasing in-state degree production was the only strategy. They also offer a very interesting list of states that are the largest net importers of college graduates, comparing state's rankings on degree production and population size. The states which appear to be the biggest importers of college graduates based on the difference in these two rankings are Alaska, California, Maryland, Hawaii, and Virginia. The states that are the largest net exporters of college graduates are Iowa, Missouri, North Dakota, South Dakota, Alabama, and West Virginia. Note that three of the large net importers are peer "Global Challenge" states, and none of the net exporters are peer states.

The Technology Alliance has argued that there is insufficient degree production in science, mathematics, and engineering programs in Washington universities based on rankings of states' degree production per 1000 student age residents in each state. They also suggest that the lack of capacity in such programs is denying current residents of the state access to high wage jobs, and that local firms, especially startups, would benefit from access to skilled workers graduating from these programs. However, the Technology Alliance has not offered any quantitative benefit estimates (Sommers and Hitachi Consulting, 2004).

These three studies suggest several policy options for increasing bachelor's level degree production in science and engineering fields:

- Improvements in K-12 science and mathematics teacher quality and quantity through focused programs in schools of education;
- Development of a mentoring system for K-12 students in partnership with workers presently employed in these fields; and

- Increased capacity at the university level in selected science and engineering fields matched to expanding industry sectors.

The literature on this topic does not provide any rate of return estimates. However, several facts suggest that returns could range from moderate to large. First, the industries that employ science and engineering graduates are high wage industries with substantial and above average economic impacts. Second, the required academic programs are relatively expensive, requiring faculty with relatively high salaries, plus laboratory space and equipment, and computers, all of which must reflect the rapidly changing technology in use in industry to be effective as teaching tools. Third, students who graduate from science and engineering programs are in great demand in many states since this is a national problem, and a substantial fraction of Washington's graduates may be lured out of state by higher wage offers of companies located elsewhere. And fourth, well established companies have the ability to recruit graduates from other states, in effect limiting the externality impacts of increased degree production in this state. Higher capacity at Washington universities would provide opportunities to the state's students but would not necessarily cause greater impact from growth of established firms. For these reasons, this investment is assigned to a medium to large impact group.

Enhancing aid to low income students

Georgia's Hope Scholarships and Indiana's 21st Century Scholars program are two examples of state efforts to increase college participation by low income students. Funded by a state lottery, the Hope Scholarships covering tuition at Georgia public institutions of higher education are offered to any Georgia high school graduate who maintained at least a B average in high school. This program has received extensive scrutiny, and some observers note that many of the recipients of the Hope Scholarships probably would have attended college without the state assistance. Without targeting based on need, it represents a large subsidy to Georgia's middle class.¹⁴ The second example gets better marks for efficiency. Indiana's 21st Century Scholars program offers similar scholarships to a more targeted groups of high school students, those who qualified for free and reduced price lunches in 8th grade and who maintained at least a C average in high school along with certain other eligibility requirements. Other states have emulated aspects these two programs. The Indiana approach is interesting because it extends access to students whose financial position might prevent going on to college. Because of the narrow focus on disadvantaged students, the budget costs have been modest and predictable. The program is costing the state \$17 million in recent years, a relatively small proportion of the \$160 million in total state tuition aid costs.¹⁵ Given the evidence reviewed in this paper on returns to investment in college education, the 21st Century Scholar model appears to be a program with modest costs but substantial impact – at least a medium and perhaps high return program. However, no rate of return estimates for this or comparable programs have been found, and caution suggests keeping it in the medium return category.

¹⁴ See for example critical comments in a newsletter from the National Center for Public Policy and Higher Education, "HOPE springs eternal," *National Crosstalk*, Spring 2003 (<http://www.highereducation.org/crosstalk/ct0303/news0303-hope.shtml>).

¹⁵ <http://www.highereducation.org/crosstalk/ct0106/news0106-indiana.shtml>

Gándara (2005) makes a case for special attention to high achieving Latino high school students, noting that they often come from disadvantaged homes. She suggests a number of policy options including counseling, access to social services, and programs to ensure mastery of college level English skills. Her arguments can be extended to other minority youth from low socioeconomic status households. The importance of dealing with this issue has been stressed above. The costs of added social service, counseling, and tailored language skill programs may be relatively modest per student, and the general returns to higher education literature suggests a positive outcome. However, given the growing number of minority students in many school districts across the state, the aggregate costs to school districts or the state budget could be significant. With no track record of success for the options Gándara recommends, this option is placed in the medium outcomes category. However, if successful, such programs could jump into the high returns category. Washington's growing Hispanic population suggests that this could be a very important investment to consider.

Training for dislocated workers

Hollenbeck's various studies suggest that workforce training programs for dislocated adult workers also belong in the medium rate of return policy options category. The GAO finding that evaluation research is generally deficient should be considered, but the work of Hollenbeck and his various colleagues suggests positive benefit-cost results for various federally-funded programs. If there is evidence of unmet need among displaced workers, the state could consider augmenting federal programs to permit longer training programs or to develop specialized efforts in new fields to match emerging industry needs.

Low Rate of Return Options

The options described below are likely to be controversial due to placement of the programs in the low return category. The available evidence does suggest that the economic returns on public investment will be lower than the economic returns for the investment options described in the high and medium return sections. However, the social returns may be significant and the increasing number of poorly educated people living in the state, often minority group members and often recent immigrants from impoverished or war-ravaged countries suggests needs the state cannot ignore, and potential future social assistance and criminal justice costs if the education needs of these populations are not dealt with. In fact, two state studies, one from California (Brady et al. 2005) and one from Texas (Murdock et al. 2002), as well as a report from the National Association of Manufacturers (2005), suggest that if state and federal programs fail to provide basic skills to poorly educated immigrant adults, productivity growth will slip, imposing a substantial social cost. The returns suggested by the literature may be low, but the imperative to deal with these issues is great!

Basic Education and English As Second Language Programs for Adults

Prince and Jenkins (2005) conducted the "tipping point" study, trying to identify key leverage points at which public investments can have substantial impacts on the future earnings of low skill adults. They assembled data on workforce outcomes 5 years after

students first enrolled at a Washington community or technical college, including students who enrolled in college credit and adult skills programs including Adult Basic Education (ABE) and English as a Second Language (ESL). About a third of these students had previously earned a high school diploma or GED, and at least one third had not previously earned a diploma or GED. Only 13 percent the students who started out in an ESL program went on to college credit courses. About 30 percent of the students who started in adult basic education programs went on to college credit courses. The workforce outcomes data showed that those who started without a diploma or GED but made it through at least one year of college credit courses had earnings substantially higher than comparable students who earned less than 10 credits -- \$7,000 higher for those who started in ESL and \$8,500 higher for those who started in ABE. In contrast students who already had a high school diploma when they first enrolled at a community college and who got through at least a year of college credit courses had earnings \$1700 higher than students who earned less than 10 credits. GED holders who entered community college and got through at least one year of college coursework had earnings \$2500 higher than students who earned less than 10 credits. The authors conclude that earning at least a year of college credit is the tipping point leading to higher wages,¹⁶ and that the tipping point effect is larger for students with the least prior education. Unfortunately their data also show that few entering students lacking a diploma or GED actually earn a year or more of college credit. Therefore the key intervention needed is a program that will keep more students in college for a longer period to earn at least a year of college credit.

Staff at the State Board for Community and Technical Colleges feel that they have designed the needed program and are seeing early signs of success. The program is called I-BEST, an acronym for Integrating Basic Education with Skills Training. I-BEST programs at several colleges show excellent results and more colleges are adopting this program. If subsequent evaluations confirm early results, this program may qualify as a medium return program, although it is a high cost program requiring two instructors in the classroom much of the time. Cost factors may keep it in the low returns category even if proven efficacious. Prior attempts to deal with the education problems of adults lacking basic education or English language skills have not been very efficacious and would have to be placed in the low returns category. Other research suggests that earning a GED alone is not an effective investment to raise subsequent earnings (Heckman and LaFontaine, 2006).

Educating prisoners

Coley and Barton (2006) make a case for education of prisoners during their incarceration and suggest that there may be positive net returns due to lower subsequent re-incarceration rates. However, they do not make any quantitative projections of the potential savings. Keeping students in high school has been associated with lower future crime rates; Moretti & Lochner suggested that a 1% increase in high school graduation rates would produce savings of \$2100, less than a third of what Washington spends

¹⁶ The tipping point effect is confirmed by Marcotte et al. (2005) using data from the National Educational Longitudinal Study; these authors found that a half year of study at a community college had no impact on earnings, while completing at least a year of study earn 5 to 10 percent more.

annually on each K-12 student. Moretti & Lochner's findings, combined with current budget data, suggest that prisoner education is a low return investment. However, given burgeoning criminal justice system costs, it may be an important investment to consider, especially if Coley and Barton are correct in thinking that the extra costs of education may be offset by lower future incarceration costs, leading to a modestly positive net outcome.

Summary and Conclusions

A vast literature on economic returns to education documents higher earnings for college graduates than for individuals who do not advance beyond high school. The progression in earnings starts with a year or more of community college education, an experience associated with earnings increases of about 10 percent. Completing an associates degree may raise earnings by 25 percent or more relative to high school graduation, and completing a baccalaureate degree is associated with earnings 40-60 percent higher than a high school graduate. These economic returns have been confirmed in studies in many countries. Despite fears in the mid-1970s that colleges and universities were producing too many college graduates relative to projected employer demand, the labor market has handsomely rewarded graduating students with higher wages in the subsequent decades, producing evidence of a widening gap in wages of graduates relative to high school graduates.

Longitudinal studies of early childhood program participants from disadvantaged families also show an economic return on the order of 15 percent or higher. Starting the education process earlier compensates for in-home influences on cognitive development that may be missing in many families.

Other studies document social returns to education. Reductions in criminal activity results in avoided incarceration costs as well as providing individuals with access to better paying jobs. A number of studies confirm this association, as well as health effects due to lower rates of smoking and other favorable life style choices more frequently made as educational attainment levels rise. In addition, several spillover or externality impacts have been shown, including higher wages for non-college graduates in cities with a higher percentage of college degree holders in the workforce, as well as higher productivity levels in manufacturing companies employing a more highly educated workforce. These externality effects imply that private sector decision-makers, including both students and for-profit firms, are likely to under-invest in education. In fact, since graduates may move to another state after completing a degree, there is an argument that only the federal government is in a position to internalize all of these effects and come to a rational decision about the optimal level of investment. A state, knowing that some of its college students may leave after graduation, may tend to under-invest particularly at the baccalaureate and higher levels.

The evidence of economic and social returns to higher education is vast and impressive. This literature may aid decision-makers struggling with difficult issues of how much higher education capacity to provide, what kinds of capacity (baccalaureate vs. community college; scientific/technical vs. humanities, etc.). However, the estimates of

rates of return reviewed in this paper are unlikely to relieve legislators and executive branch leaders of the need to make difficult decisions regarding whether to provide more capacity that will aid those likely to contribute higher earnings in dynamic sectors of the economy vs. expansion of basic education that will aid disadvantaged students and adults seeking a lower level education needed to break into a living wage segment of the labor market. The evidence provided above is somewhat incomplete and varies in the extent to which costs are considered as well as benefits, making a precise rank ordering of investment options impossible.

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